

The Copernicus grave mystery

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When in 2005 Polish archaeologists led by Jerzy Gasowski found fragments of a skeleton tentatively identified as the remains of the 16th-century astronomer Nicolaus Copernicus, some doubts remained. Now, in this issue of PNAS (1), these issues are resolved with high confidence through DNA analysis.

Nicolaus Copernicus was, literally, the man who invented the solar system. He noticed that by rearranging the circles of the ancient Ptolemaic system so that each planet, including the Earth, moved around the Sun, something beautiful happened. The fastest-moving planet, Mercury, revolved closest to the Sun; the slowest, lethargic Saturn, came at the outer fringe of his planetary system; and the others neatly arranged themselves by period. "In no other arrangement," Copernicus exclaimed, "do we find such a harmonious relation between the size of the orbit and the planetary period" (2).

This result was not the consequence of new observations. It had been waiting for centuries for someone daring enough to suggest that the Earth was in motion and the Sun was fixed. Copernicus was not a particularly accurate or busy observer, although he took care to observe the planets at selected critical moments to confirm the parameters established long before by Ptolemy. Hence we have only a few score observations from Copernicus himself, and he recorded six of them, of eclipses, near the images of eclipses in a calendrical treatise that he owned (3). It was a copy of Johann Stoeffler's *Calendarium Romanum magnum* published in Oppenheim in 1518.

Some decades after Copernicus' death in 1543 the Swedish army plundered northern Poland during the Thirty Years War, capturing the books from the Frauenburg Cathedral. There Copernicus had spent the final years of his long term as a canon in the cathedral chapter, serving among other tasks as a legal officer and physician. The major part of his personal library and many of the books he used from the cathedral library ended up in the Swedish university town of Uppsala. As one of my Polish colleagues remarked, "the books have been very safe there," for so many Polish cultural treasures have been lost as armies have crossed their lands in the ensuing centuries.



Fig. 1. Copernicus' annotated copy of the *Calendarium Romanum magnum* takes a central place in this photograph of his books at the Uppsala University Library. In the foreground is a Regiomontanus title known to have been used by Copernicus but not located, so a substitute copy completes the picture. Photograph by Owen Gingerich.

In 1973, the quincentennial of Copernicus' birth in 1473, I accompanied the American designer Charles Eames on a photographic tour of Copernican sites in Poland and his library at Uppsala University. It took me an entire morning to write out all of the call slips for the Copernican books in Uppsala, because at that time they were not kept together in the library stacks. But the *Calendarium* was not among them, for it is owned by the university's astronomical observatory. However, I knew my way around the observatory's rare book collection, having spent time there several years earlier, so I simply walked over to the observatory and carried the precious volume back to the university library for the group portrait shown here (Fig. 1). I still shudder to think of the lax security, which fortunately was only in a bygone era.

The *Calendarium* plays an unexpected and critical role in the article by Bogdanowicz et al. (1). But we need a little more background. Although not ordained as a priest, Copernicus was nevertheless in charge of one of the altars in the cathedral. On May 24, 1543, on the very day the remaining pages of his cosmological masterpiece *De Revolutionibus* arrived from the printer in Nuremberg, Copernicus died, and as

was the custom, he was interred below the floor of the cathedral near the altar he had maintained. His grave, however, was unmarked and its exact position was forgotten.

Enter the Catholic churchmen at today's (now Polish-named) Frombork Cathedral. Given the advances in science ranging from below-ground scanning to detect altered soil to DNA analysis, they decided to give the archaeologists a chance to excavate the disturbed ground in the vicinity of the St. Cross Altar. In the summer seasons of 2004 and 2005 the archaeologists excavated the areas in two sides of the altar, finding in 2005 at the lowest level the scattered bones of a 60- to 70-year-old man, the only skeleton that approximated Copernicus' 70-year life span. They recovered a cranium, but not the mandible.

At the Central Forensics Laboratory of the Warsaw police, experts reconstructed the face and compared it with the best known portrait of Copernicus, which hangs in the Town Hall in Torun,

Author contributions: O.G. wrote the paper.

The author declares no conflict of interest.

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his birthplace. Here again a piece of detective work is in order. On the wonderful astronomical clock in the Strasbourg Cathedral in France there is a portrait of Copernicus with a large caption proclaiming, "A true likeness from his own self-portrait." Painted by the 16th-century Swiss artist Tobias Stimmer in 1571–1574, the portrait was based on a painting sent from Poland at the time (4), and the caption provides our only evidence that Copernicus had made his own self-portrait, perhaps only a black and white pencil sketch, or something more elaborate. The close resemblance of the Town Hall portrait in Torun to the Stimmer painting in Strasbourg and his woodcut version in a portrait book of 1587 gives some confidence that the Torun oil painting derives from the same original source. (For color images side by side, see plates 2 and 3 in ref. 5.) In any event, the Warsaw forensics experts pointed out evidence of a broken nose and a

forehead scar that seemed to match between the cranium and the portrait. Still, there were lingering doubts as to whether the archaeologists had gotten their man.

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And now the DNA analysis enters the story. Alerted to the search for DNA from a collateral descendant of Copernicus, Swedish researchers noticed the possibility of finding some Copernican fragments in one of the books the Polish cosmologist had annotated. Whether they tried more than one book we have not learned, but in the *Calendarium* they

located 9 hairs, of which 4 were suitable for extracting DNA under carefully controlled sterile conditions. Two of the hairs match the DNA segments from a well-preserved cranial tooth, according to Bogdanowicz et al. (1). Their research is a wonderful denouement for the Copernican Grave Mystery. But I cannot help but wonder whether one of those other hairs was mine!

Two footnotes need to accompany the article by Bogdanowicz et al. (1). Despite their casual statement that Copernicus was a priest (a rumor apparently initiated by Galileo), modern scholarship denies this, attributing only minor orders to the astronomer (6). Second, they have noticed a gene generally associated with blue eyes, whereas early portraits show Copernicus with dark eyes. But, as indicated above, the evidence for Copernicus' eye color from early portraits (none contemporary) is very sparse, and Copernicus could well have been blue-eyed as far as the historical record is concerned.

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4. Metze G (2004) *Katalog der Copernicus-Bildnisse, Nicolaus Copernicus Gesamtausgabe, Band IX*,

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